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ABSTRACT

This paper was presented during the time the author was president of the Council of Educational Facility Planners, International, (CEFP/I). The presentation begins with a summary of the state of the world's natural gas and petroleum supplies and states that since one-third of all energy consumed in the United States is to heat and cool buildings, schools offer a huge opportunity to conserve vast amounts of energy. The energy policy of CEFP/I is presented and used as the basis for a discussion of the commitment to human as well as finacial considerations in accepting or rejecting an energy conservation matter. The main thrust of the paper is that there is much that can be done today in a building design to dramatically reduce energy use as well as alter how and what energy supply is used. The author discusses 20 specific energy conservation items that can be applied today and describes how his architectural firm uses these considerations in the educational facility planning process. (Author/MLF)

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Topic: Practical Applications of Energy Conscious Design and Re-Design Techniques

Session: Monday, February 20, 2:00 p.m. Room 208

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

CREATING ENERGY-EFFICIENT BUILDINGS

GREETINGS.

The energy situation faced by our nation and the world is extremely critical. Much has been written and spoken about this subject. Each person must sort through the information and reach his/her own conclusion as to length of the lifeline of critical energy resources.

Although there are differences in opinions as to how long our supply of natural gas and petroleum will last, there is one significant point upon which I have found no disagreement--that being: Some time in the future, we will, as a world, have totally consumed our natural gas and petroleum supplies. Thus, the world is left with the absolute necessity to change its sources of energy. My view is that we have only a small precious amount of time left, and we must stop talking so much and begin doing more about it.

Approximately one-third of all energy consumed in the United States is to heat and cool buildings. The majority of these are public or institutional buildings, and further, the majority of these publid or institutional buildings are schools. Therefcre, schools alone offer a huge opportunity to conserve vast amounts of energy.

Much of what you read and hear today concerning new forms of energy leaves the impression that the technology we need to adjust building designs to make them energy-conservative is perhaps 20 to 30 years away. The impression is often given that to conserve energy, essentially all we can do now is adjust our use of buildings, tune up motors and furnaces, and make minor design adjustments. Many have unfortunately come to this conclusion. In my opinion, this is not correct and there is much that can be done today in a building design to dramatically reduce energy use as well as alter how and what energy supply is used.

The use of conservative energy design and new energy forms will greatly decrease the amount of present day energy consumed. Perhaps new energy technology is ready to use in the design of buildings more than in any other segment of the energy situation.

The main thrust of today's presentation will be to discuss a number of specific energy conservation items and means to prepare and use new energy forms that should be considered for use now in planning schools.

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If we proclaim ourselves to be education facility planners in today's world, we must be experts concerning energy. Time and events have placed upon us some very serious and unique responsibilities to great magnitude. We should be among the first to throughly understand what can be done to conserve energy use in buildings. We must begin doing something about it today, not tomorrow. We must also tell others thoughtfully and carefully what can be done to conserve energy in educational facilities and how to equip schools with new energy sources.

I will discuss 20 specific items that can be applied today. I also will describe how our firm uses these considerations in our educational facility planning process.

First, I would like to discuss the energy policy adopted nine months ago by the Council of Educational Facility Planners.

There is a unique and extremely important aspect of the Council of Eduational Facility Planners' energy policy as compared to must of what is read and heard. It makes commitments to <u>human considerations as well as financial considerations</u>.

Following is the energy policy for the Council of Educational Facility Planners, International. CEFP/I is to be greatly commended for its expression of human concerns and of how these concerns need greater consideration when discussing energy use. It is important to underatand this in relation to remarks I will make.

CEFP/I ENERGY POLICY:

The Council of Educational Facility Planners, International, adopts the following policy concerning its role in the serious energy considerations facing our nation and the world.

Perhaps the most significant condition affecting our nation's future during the next several decades will be the misuse and scarcity of conventional energies. Time is short. Massive conservation efforts and the development of new energy sources must take place.

CEFP/I believes the energy situation is a crucial global concern which must be viewed from both ecomomic and humanistic standpoints. CEFP/I feels it is not sufficient to develop a plan of action solely on the basis of financial projections. In the span of our lifetime, two crucial energy sources (petroleum and natural gas) could be depleted. If we are to leave something for our children and grandchildren, we must take steps to conserve finite energies, to make them last as long as possible, and to concurrently engage in efforts to develop new sources of energy.

Approximately one-third of all energy used by our nation is consumed in operating buildings. Educational facilities are the largest group of institutional buildings. In schools alone, the potential for saving our finite energy resources is immense.

The immediate task is to convence the American public that it faces a situation as grave in severity and magnitude as war. Unless we conserve energy supplies now, we probably will not have the time and capability to develop new energy sources nor the opportunity to make transitions to new lifestyles without traumatic social and economic disturbances.

It is troubling that many citizens do not apprehend the seriousness of the situation. Quite possibly, this naivete' will persist throughout the lifetime of our current middle-aged population. Therefore, hope for the survival of our nation may lie in the hands of our young people. Thus, the schoolhouse must illustrate energy conservation methods and the use of new energy technology. The schoolhouse must be an example.

The Council of Educational Facility Planners, International, as a recognized leader in the art of planning, constructing and maintaining the educational environment, accepts the responsibilities our organization holds in the current energy crisis and adopts the following goals:

1) CEFP/I will gather information about the nation's and the world's finite energy supplies. The condition of these energy resources will be reported not less than quarterly to our members.

2) CEFP/I will especially study all endeavors concerning development of new energy technology and will report progress to its members not less than quarterly. Such study will make a great effort to sort our scientific hypothesis from technical and economic fact.

3) CEFP/I will promote and join hands in test applications of new conservation methods and development of new energy forms. In joining hands with educational systems, industry, engineers and architects, CEFP/I will perform a role chiefly as a communications link in the testing, reporting and documentation of findings.

4) CEFP/I will establish and maintain a library related to energy use in educational facility design. The goal will be to establish a complete library resource of energy information for use in designing, using and renovating energy-conservative educational facilities. The library will publish not less than quarterly an acquisition list and will function as a clearing house for information.

5) CEFP/I will conduct workshops throughout the United States and Canada on energy use and educational facility design. Workshops will be tailored to specific energy concerns. Although general with respect to current energy conditions, the workshops will be precise in focusing on aspects of conservative design and use of school buildings.

6) CEFP/I will become a national resource of development of computer-based simulation programs for use in life cycle costing and in planning and designing facilities in relation to their future energy use. Realizing that such computer programs are extremely expensive, CEFP/I will solicit funding and become a national resource in development of computer-based simulation packages in the planning of educational facilities.

7) CEFP/I will compile and publish an energy notebook particularly related to educational facility design. It will contain information required by educational facility planners to meet current and future challenges in relation to energy. The notebook will be loose-leaf in format to facilitate addition or adjustment of material.

8) CEFP/I will concentrate on developing the planning process referred to as "futuring". A serious energy situation may be only one of the critical shortages faced by the world. Clearly, futuring is required and CEFP/I commits itself to its refinement and use by educational planners.

Schools must be hallmark examples of new energy technology. It is to these purposes that the Council of Educational Facility Planners, International, dedicates itself in the next decade and beyond.

It seems essential for everyone involved with buildings to fully underatand the very important aspect of the CEFP/I energy policy... the commitment to human as well as financial considerations. Broadening energy discussions to include the human aspects of the energy situation changes the "mind set" of most poeple. It will result in better energy-conservative design for educational structures.

Most everything you read and hear concerning energy discusses the financial implications. Typically, the question is "Will whatever is being proposed pay for itself in a selected number of years?" Certainly, financial considerations regarding energy are absolutely necessary to consider when planning the design of an educational facility. However, thare are other equally important aspects that must be addressed. It is essential this point be carefully studied. It is a powerful starting point that adjusts your frame of mind to adopt energy-conservative design changes now, not later.

The typical cost analysis of a proposed energy conservation element projects a payoff time and suggests a conclusion as to whether it is financially feasible. This is the main thrust of current life cycle costing processes. This is good, but remember, future energy costs are put into the study based upon ideas of the person writing the computer program. Therefore, what is being analyzed cannot be established as absolute fact. It is an opinion.

Another view of the cost picture is from the human standpoint--the need to conserve and extend finite energy resource lifelines. If we continue to consume natural gas and petroleum at our present rates, and thus are so foolish to exhaust our supplies in a short period of time, the results could be utterly catastrophic. Such a catastrophe would bring misery to

humanity, probably beyond description. Thus, there is a patriotic duty for each of us to perform for our nation and the world....the duty to conserve energy.

Using most energy-conserving design elements will probably result in increased costs for mechanical or other building systems. In the case of new buildings, it is possible to acquire the funds for these energy-conservation measures by simply reordering budget priorities. In the case of modernizing or retrofitting, perhaps there are no priorities to restructure and cost required for the energy modifications becomes of critical concern.

The simple fact is that it will cost money to make our buildings more energy-efficient and the costs will remain no matter how many computer runs are made. The major point I make is that it is absolutely essential to understand and accept the fact that there are reasons other than financial to consider when you are accepting or rejecting an energy conservation matter.

Looking directly at the educational facility planning and design process, we have found that to obtain serious client consideration, a stage must be carefully set to establish clarity of energy conservation measures proposed. In most cases, each of your states has established energy regulations pertaining to buildings. In my state, Washington, we have a set of energy guidelines that must be incorporated in the design of new or modernized buildings. Therefore, it is assumed that this standard (the minimum energy adjustment requirements) will be met.

In the process of communication during planning, we found it is a significant step forward to express energy regulations in Btu's of energy required per square foot per school year. We chose this becuase the federal government speaks of goals in the neighborhood of 50,000 to 55,000 Btu's of energy used per square foot of building per year. We found that in our state, if we comply to the energy regulations, schools will use in the neighborhood of from 70,000 to 85,000 Btu's of heat per square foot per school year. This, of course, will vary with the type of school and various state regulations. We assume good building design will achieve this standard.

This state energy conforming building is the starting point. It is the starting point because there is a great deal more you can do to reduce total energy consumption both in present and future forms. It is the additional measures that seem elusive to many and in most cases are overlooked.

We have the technology for energy conservative design available to us today to further reduce energy use by another 40 percent to 50 percent. In other words, you can take what seems to be a good energy-efficient design and probably cut its energy consumption in half.

Following are some new energy forms and energy conservation items ready for use in facility design process.

1) <u>STORAGE</u>: An essential ingredient in the design of a new building or modernization of an old one is inclusion of an energy storage system. In my judgment, not a single new building or renovation of an old one should take place today without inclusion of such a storage system.

I am aware of three current ways to store energy. They are water storage, rock storage, and eutectic salt storage. Even if storage systems are not totally activated presently, it is imperative they be included in your building design.

Let's look at advantages of water storage. Heat can be gathered from those sources that may be generating heat inside your building and held in the "water energy storage bin." Perhaps the structure is large and has a central core with excess heat that in past designs would be wasted. With water storage, this heat can be captured and stored in the water to use at a later time. If the energy source is electric, the energy for heating can be purchased at an off-peak demand time, such as the middle of the night rather than at 8:00 in the morning at a high-demand time. This not only saves money because of less costs for electrical energy, but will also reduce the overall capacity need for electric power generating plants. This has a powerful effect on a national and international scale because total electrical generator needs are reduced.

Some buildings work better with rock storage. We currently have a building, the Kitsap Peninsula Vocational Skills Center, that has five large rock storage bins. This new structure does not have a source of heat inside the building significant enough to be collected and stored. However, with rock storage, the building is ready to connect to solar collector panels in the future. Also, electrical power can be purchased during the night to heat the rock storage bin for use during daytime hours.

Salt storage is a more sophisticated storage medium. It is also the most costly, and we know little about its proven performance over a large number of years. It appears, however, to be a highly efficient means of heat storage.

Thus, it is essential that a building designed today have a storage system. Every new structure in our office currently under design has a storage system. Three of the buildings we are working on have water storage systems ranging from a few thousand gallons of water to as high as 40,000 gallons. Other buildings have rock storage systems.

2) HYDRONIC HEATING/COOLING SYSTEMS: Using water as a means of storing and transmitting heat is an important energy-saving concept. Once there is a storage system, if the building is properly designed for the future, there also must be a way to transport stored heat throughout the building--in other words, a distribution system. Thus, a hydronic (water) heating/cooling system is extremely attractive.

The water system makes it possible to use stored heat from water storage often located at subterranean levels of the building. It is in this manner that excess heat can be stored in water and then moved through the piping system to be used throughout the building where required.

The water piping system will not only have its normal connections to its traditional source of energy, but also will have connections to water storage in subterranean spaces and the roof level for future solar energy collection devices. Thus, you have a complete chain established for energy collection, storage and distribution through the use of a hydronic heating/cooling system.

3) BUILDING ENVELOPE: A building may be thought of as a collection of elements, each performing certain roles in the general function of a facility. Elements such as heating, cooling, and lighting require addition of energy to perform their functions. The building envelope consists of those elements (roof, exterior walls, and floor) which provide separation and protection from weather and other natural forces. The design of this envelope is immensely important in achieving an energy-efficient building. Many things can be done to improve the building envelope, including: double glazing or triple glazing windows, wall insulation, increasing roof insulation, light color roof, reducing windows, earth berms, minimum fenestration on north or weather side, trees or vines on south, east and west sides, vertical fins on east and west windows, overhangs on south windows, etc. All these items can be sued in various ways to make the building envelope more energy efficient. Dramatic energy savings can be accomplished by carefully meshing together a proper selection of these elements for each building design.

4) SOLAR ENERGY COLLECTION: There are a variety of solar collecting devices on the market today. They are generally separated into two types: those that collect heat through a liquid system, and those that collect heat through an air system. There is much rhetoric about solar collection, which tends to often create the impression that solar collection is not practical at the present time. I do not believe this to be the case, and feel that we can obtain energy from the sun with collecting units presently available.

Often a confusing part of energy-efficient design is the concept that perhaps there are one or two significant things that can be done to solve all the energy needs. This is simply not the case. You arrive at an energy-efficient building by doing many things. The combined total of these items brings about the dramatic adjustment and achievement of a very fine energy-efficient structure.

The energy situation contains the brutal fact that our finite energies of petroleum and natural gas will at some time be completely exhausted.

According to figures from the Federal Energy Administration, as of November 1, 1977, there were 2,596 "oil days remaining." That is, at the present rate of consumption, our known, proven reserves of domestic oil would last another 2,596 days, or approximately seven years.

The total technology needed to exist in a world without petroleum and natural gas is not available today. It is, therefore, essential that existing supplies of these finite energies be conserved so their lifeline is extended to the maximum time.

Although many aspects of the energy problems do not have answers in the form of new technology, we do know much about design and operation of buildings utilizing energy-saving design practices, including solar energy.

Economic considerations involving the use of solar collecting devices must be thoughtfully studied; however, it is essential that even though solar energy collecting devices might not be placed on new or modernized buildings today, designs should be such that they could be added in the future.

5) BUILDING ORIENTATION: Many things seem obvious concerning orientation of a building on a site to conserve energy. In addition to these obvious areas, frequently additional site orientation study will reveal further energy-conserving features.

The necessity for favorable areas for solar collection is, of course, a must. Another site feature is the use of earth berms. In the design of schools, using berms directly against the building often leads to heavy cost becuase of many required exits from the building. If the site is slightly rolling, serious consideration should be given to siting the building on a knoll and cutting down into the knoll to create a plateau for the structure. The actual berms in this case can be held some distance from the building where they will provide excellent wind breaks from colder winds, yet will not block entranceways or windows as desired in the main walls of the structure. Good water drainage can be obtained because of the location on the knoll.

When you feel you have completed your analysis, return to the site and restudy every detail; chances are, you will find additional items you can do to conserve energy. Often, they will be low-cost considerations.

6) ON-SITE WELL WITH HEAT PUMP SYSTEM: The availability of ground water is an important item to check. If wells are commonly achieved in the area where your building is located, consideration should be given to use of an on-site well heat pump system. Basically, the system consists of using well water as a heat source in cooperation with a heat sink to accomplish environmental needs.

Two wells should be used located not more than 50 to 100 feet apart. They should also be located close to the building. Water is pumped out of the ground at plus or minus 55°F and returned to the ground at plus or minus 45°F in the heating season and at plus or minus 65°F in the cooling season. The water would be circulated through a heat pump located in the building.

The reason for the second well is to reduce environmental impact. If everyone should carelessly start using wells to heat and cool their buildings, it could change ground water levels. Thus, an intricate part of this system is the second well where water can be returned. The only environmental significance is that when heating, the water will be returned approximately ten degrees cooler and when cooling, it will be returning about ten degrees warmer.

This is the one type of system that almost eliminates the need for storage.

7) WASTE WATER HEAT RECLAIM SYSTEM: It is important when you start the study of your building to carefully construct, in a visible form, the basic places where energy will be used. We often use a circle divided into pie shapes showing percentages of energy use. In most high schools, approximately 25 percent of all energy is consumed to heat domestic hot water. With such a major portion of energy going toward this need, it becomes realistic to consider a way to reclaim heat literally going down the drain.

Reclaiming takes place in areas of heavy water use, such as showers. Basically, warm waste water flowing in shower drains is collected in an insulated water storage tank. Chilled water is pumped in closed piping through the warm waste water. As it passes through, heat will be transferred. A water chiller is used to transfer heat from the warm water to the incoming cold domestic water. With systems such as this, you can recover approximately 80 percent of the heat that would have been lost in waste water.

8) BUILDING MASS: Schools are rather unique as compared to other buildings because of the large number of people that occupy them. Occupants bring much body heat into a structure. Also, the school functions require a reasonably high level of lighting. This too, generates heat. By creating the shape of a building so that it is nearly a square, making a large central mass, it is often possible to literally get all the heat you need for heating from the building's core. This excess heat in the central core can be gathered and redistributed to the perimeter of the building for heating needs. Also, this heat can be gathered and stored in the building's storage system for later use if desired.

There is no doubt that simple building shapes with building mass have distinct possibilities for energy savings.

9) DESIGN TEMPERATURE ADJUSTMENTS: Normal exterior design temperatures used for calculating heat loss will vary from location to location. In the Puget Sound Area in the past we have used 15°F as the low and 72°F as the high. These temperatures are used to calculate equipment sizes. Outside temperatures of 15°F in our area are an infrequent happening. Thus, it is reasonable to consider designing systems for an outside winter temperature of 25°F. The result is obvious--smaller equipment loads and less energy used. In the summer, it is quite possible to say that 78°F is the design temperature rather 72°F. There may be a few days when the interior building environmental conditions will not be perfect, but they will be tolerable. In almost every climate some design temperature adjustments are possible.

Also consider the use of natural ventilation. In early history, enclosures were simple using natural forces for conditioning. As building technology progressed through the years, it moved away from simple solutions of ancient history and continuously reflected more technological sophistication to fulfill rising expectations of comfort and performance.

Advances in various mechanical environmental controls and artificial lighting essentially severed the simple dependence on natural forces. Use of this technology and these conveniences has led to a tremendous rise in the modern person's expectations of their environments.

Creations of these environments and maintenance of expected comfort conditions within them have been accomplished with the expenditure of vast quantities of energy. The great and urgent need to conserve our finite energy sources makes it mandatory for us to reduce energy and re-examine how building systems should be designed.

Adjustment of design temperatures is a very logical thing to do.

10) WIDE BAND THERMOSTATS: Expanding the deadband range on thermostats of from one to two degrees to six to eight degrees is another effective way to save energy.

Over the years, technology has become so exact that many new buildings keep heating, ventilating and air-conditioning equipment operating almost continuously to maintain a given temperature. Many times, occupants are not nearly as sensitive as the equipment, and to expand the deadband (that portion of the time when the mechanical system does not need to operate), from one degree to six or eight degrees makes a tremendous difference in energy requirements. This is an excellent feature to embody in your design concepts.

11) LIGHTING REDUCTION: In schools, lighting is one of the major target areas for energy conservation. Energy analysis of one structure under design in our office at the current time (Kitsap Peninsula Vocational Skills Center) shows that approximately 46 percent of all energy used would be for lighting, unless steps are taken to offset it.

High lighting levels typically used throughout modern interior environments are very costly from an energy consumption standpoint. High energy consumption results both from energy needed to operate lights and additional energy needed to cope with heat build-up caused by the lights. Often the need for air-conditioning is forced because of the immense amount of heat generated by lights.

Further, adoption of other energy-saving design features can increase the seriousness of high lighting levels. For example, when the building envelope has been improved to provide outstanding protection from the elements, it also better contains heat. Thus, in the center of buildings, heat build-up of lights can be intolerable and often forces the need for air-conditioning. Therefore, the return to more modest levels of lighting is an important part of the energy-saving process.

Currently, we are modernizing a 10-story office building. When complete, Floors 2 through 9 will have task/ambient lighting. There will be NO ceiling lights.

It is hard to conceive of an educational facility that needs to have an overall lighting level maintained in excess of 50 foot-candles. Perhaps even this is high. With lower lighting levels, additional light where required can be handled by supplemental task lighting.

12) UNOCCUPIED SPACE SHUTOFF: When we leave a room of a building we use a light switch to turn off the lights. The energy-saving concept suggested here is to broaden the idea of switching just the lights off and include turning off the entire building system for that area.

In the design of new structures following a systems design concept, it is much easier to provide the unoccupied space shutoff feature. Systems designed buildings usually speak of what we term a super module. In schools, this usually ranges from either a 28-foot square upwards to a 30-foot square. The buildings are designed to the maximum extent possible to live within the concept of reusing this same super module until you have the entire building area required.

Such a building design concept facilitates application of the unoccupied space shutoff feature. The super module is used and in a broad sense each of these super modules is a building within a building and is provided with a complete system shutoff.

13) SKYLIGHTS TO REDUCE ARTIFICIAL LIGHT REQUIREMENTS: Having lived through the skylight era for school design, I never would have guessed it would return. Like all things, skylights, under certain conditions, have great value.

Double and triple glazed skylights with moveable insulated closures should be considered in areas where energy use for lighting is high.

It should be obvious that is used carelessly, at the same time natural light may be obtained, the energy losses in other regards could exceed the gain. Closing the skylights in non-daylight hours is wise in most cases.

14) CENTRAL MONITORING OF EQUIPMENT: A radio that is not properly tuned will not produce good sound. A car that is not properly tuned will not run very well and may consume more gas than normal. Likewise, a building must be properly tuned in order to function efficiently.

There are some elaborate and costly ways to monitor mechanical and electrical systems through the use of a computer. These systems are not always practical because of their heavy cost and sensitive operation. However, monitoring systems are available that are economic to install and simple to observe. Thses systems, through electrical connections, keep track of mechanical equipment and indicate by the use of visual and audio signals when a piece of equipment is not properly tuned. Central monitoring is an excellent energy saving feature.

15) DOUBLE DOORS ON MAIN ENTRANCES: The simple use of a vestibule can be an effective way to save energy in heating and cooling seasons. Often, the vestibule is not included in school design because it is a barrier to smooth traffic movement. The loss of this vestibule feature has caused an increase in the use of energy. It is a simple and relatively low-cost way to conserve energy.

16) UNDERGROUND BUILDINGS: A properly buried building would maintain a constant temperature of approximately 56·F regardless of outside temperatures. The results of energy savings are obvious. This way of saving energy should be a conservation item you consider.

Like all things, an underground building is not always practical. Undergroup buildings usually have some windows. It is amazing what can be done with a few windows thoughtfully placed. This spring, I visited the new Health S rvices Center at San Francisco State University. It was, in essence, a totally buried building. You walk up and over it as you cross the campus. The design did, as it winged out for its entranceways, include some windows. It also had a discrete center light core. The results are very dramatic and it was a beautiful, comfortable building.

17) WIND GENERATION: Wind generation can be used to generate electricity to run lights, or perhaps even easier, for heat storage. We are designing a structure which will have a rock storage system and we hope to add wind generation designed particularly to create heat in the energy storage bin.

Naturally, wind conditions vary from location to location and from site to site. This is, however, a viable means of adding another energy conservation feature to a new or existing building.

18) LOCATE LOW TEMPERATURE AREAS ON THE COLD BUILDING SIDE: Often some areas within a building do not require the same degree of heating as other areas. Identifying such areas, and placing them on the colder side of a building, the side facing the prevailing wind, saves energy for heating. This is particularly true where it may not be possible to get full protection from cold winds. Thus, a rearrangement of functional areas within a building may bring about energy savings.

19) FLOW RESTRICTORS ON WATER SOURCES: This is a simple way to conserve both energy and water. Flow restrictors are placed on faucets and showerheads. Temperatures can also be controlled to further reduce energy consumption.

20) ROLL-DOWN WINDOW SHUTTERS ON EXTERIOR WALLS: This device is an excellent way to cope with the loss of conditioned air through glass areas. It has been used for hundreds of years in Europe. It is interesting to note that this feature could also be a practical method of controlling vandalism. Roll-down shutters would seal off all glass areas at night. Similar shutters are now being used with skylights to conserve energy at night.

There are more energy-saving features ready for use today. In actuality, the list I have given you, if separated into all its pieces, would double the energy-saving items for consideration.

I want to stress that it is using a group of these items that brings about significant energy savings. Also, you must move away from the concept of always theoretically, proving that they will pay for themselves in a selected number of years.

It is my hope this list of energy conservation items available for planning our buildings is expanded. One of the energy goals adopted by the Council of Educational Facility Planners, International, commits itself to this purpose. We are beseiged with information that becomes very confusing. Someone must carefully study technological development and advise us concerning energy-saving items ready for use.

Being knowledgeable of a large palette of energy-saving considerations for the design of facilities is not enough if there are not effective ways to turn them into reality. Problems arise when asked to prove their financial feasibility. There are always readily avilable reasons why most energy conservation areas may fail. In discussions, these considerations will probably be the first to surface.

Another significant handicap encountered by the planner or designer is how to communicate energy-saving proposals to his client. One must sort those things that represent a normal, acceptable solution from those special energy-saving features that can be included in the project budgets from those that would require special grants.

The establishment of a base building to work from is a significant key in the communication process. In our state, as I have discussed, a new or modernized school facility should result in a building using from 70,000 to 85,000 Btu's of heat per square foot per school year. Assuming this is normal, it becomes the starting point for the extra effort of energy conservation.

At this point, value engineering needs to be accomplished on the design. We perform this function by reassembling the design team leaders, including engineers. We place ourselves into a retreat situation and simply "have at" the building to "pound out" every possible energy-saving concept that seems to apply. These results are then put into a special energy study report, which becomes the method of communication with our client and all others involved in the project.

In a few short years we will look back upon this process and consider it very elementary. However, in the meantime, it is a way to accomplish new energy conservation goals. We are in a transitional time. Planners and all involved with educational facility design must develop a whole new assembly of things to be added to their knowledge of facility design. It will take a while for us to become comfortable with these new concepts and use them in the same way we have used brick, concrete and wood in the past.

Following are example energy study reports. These are the results of thoughts and processes I have discussed with you. They are all active projects in our office.

The processes outlined will assist in achieving higher standards of energy-conscious design. There isn't anything startlingly new in what I have said. All of the ideas can be found in various sources and have been written about many times. Perhaps if there is one new thought projected, it is the idea of moving from rhetoric to action. Somehow, energy proposals and discussions seem to invariably get bogged down, lose momentum, and basically get nowhere, while at the same time, the lifeline of our finite energy resources becomes shorter.

As educational facility planners, we must not only be experts in our knowledge of energy, energy-conscious building design, but we must also be leaders in bringing this knowledge to others. Schools must truly become hallmark examples of energy conservation.

END/CREATING ENERGY-EFFICIENT BUILDINGS